Debbie Beadle

From: Evan Maxim
Sent: Tuesday, March 26, 2013 4:40 PM
To: Melonie Anderson
Cc: Debbie Beadle; Susan Cezar; Kathy Curry; Kamuron Gurol; Eric LaFrance
Subject: FW: Osgood Property - Level One Downstream Analysis dated 3/22/13 (05131)
Attachments: 07 Osgood property - Triad - cover letter and Level 1 downstream analysis 13-0322.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Public Comment on ECA update

Evan Maxim
Senior Planner
City of Sammamish
425.295.0523

Effective March 1st, my email address is: emaxim@sammamish.us. Emails sent to my old email address are being forwarded temporarily, however please update your email address for me accordingly.

From: Don Hill [mailto:dhill@triadassociates.net]
Sent: Tuesday, March 26, 2013 12:59 PM
To: Evan Maxim
Cc: Eric LaFrance; Kamuron Gurol; jim@officefinder.com; susan@susan-richardson.com; Rick Tomkins
Subject: Osgood Property - Level One Downstream Analysis dated 3/22/13 (05131)

Evan,

We provide the attached Level One Downstream Analysis dated 3/22/13 (PDF) for the Osgood Property for your review and comment.

As outlined in the cover letter, in our opinion, there is sufficient capacity in the existing downstream system to convey developed storm drainage flows from the Osgood Property to the Lake.

Please reply with your concurrence or any comments.

Donald J Hill, PE | Project Principal

Triad Associates
12112 115th Ave NE
Kirkland, WA 98034

M: 206.794.9304 (mobile)
D: 425.216.2132 (direct)
E: dhill@triadassociates.net
W: www.triadassociates.net

Civil Engineers | Surveyors | Planners | Landscape Architects

EXHIBIT NO. CC27

+FSD

March 22, 2013

TRIAD ASSOCIATES

12112 115th Avenue NE
Kirkland, WA 98034-6929

425.821.8448
425.821.3481 fax
800.488.0756 toll free

www.triadassociates.net

Evan Maxim
City of Sammamish
801 228th Ave SE
Sammamish, WA 98075

RE: **Osgood Property**
19661 SE 24th Way
Triad Job No. 05-131

Dear Evan,

We provide the attached Level One Downstream Analysis dated 3/22/13 for the Osgood Property for your review and comment.

The Osgood Property does not have an active permit with the City however Mr. Osgood is involved with discussions with various parties regarding City code language that may affect the future development of his property. The enclosed Analysis was prepared to provide a review of the drainage corridor downstream of the Osgood Property in accordance with current City storm water review standards.

As discussed in the attached, there are no documented or observed capacity deficiencies in the existing conveyance system downstream of the Osgood property

Also, as outlined in the attached, the permanent flow control facility on the site is planned to be designed and constructed to conform to the City's adoption of the 2009 KCSWDM, using the Level 3 flow control standard. Compliance with the Level 3 flow control standard would reduce the post-development flows to be less than the pre-development flows from the site modeled in the forested condition.

Therefore, in our opinion, there is sufficient capacity in the existing downstream system to convey developed storm drainage flows from the Osgood Property to the Lake.

Please reply with your concurrence or any comments.

Sincerely,

TRIAD ASSOCIATES

Donald J. Hill, P.E.
Principal

cc: Eric LaFrance, City of Sammamish
Kamuron Gurol, City of Sammamish
Jim Osgood, Owner

attachment

Osgood Property

LEVEL ONE DOWNSTREAM ANALYSIS

Sammamish, Washington

Issued: March 22, 2013

Prepared For:

Mr. James Osgood
19661 SE 24th Way
Sammamish, WA 98075

Prepared By:

Kevin C. Flynn, PE

Reviewed By:

Donald J. Hill, PE

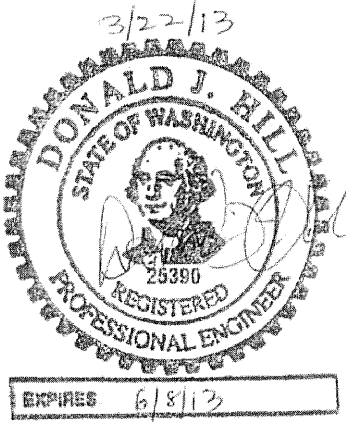


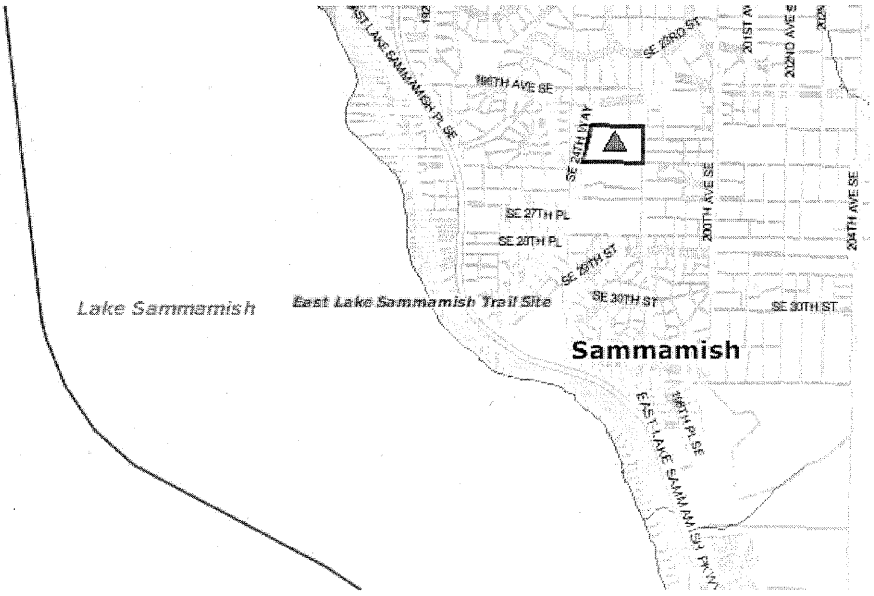
Table of Contents

LIST OF SUPPLEMENTAL INFORMATION

Note: Where applicable, supplemental information is located at the end of each section.

1 STUDY AREA DEFINITION AND MAPS

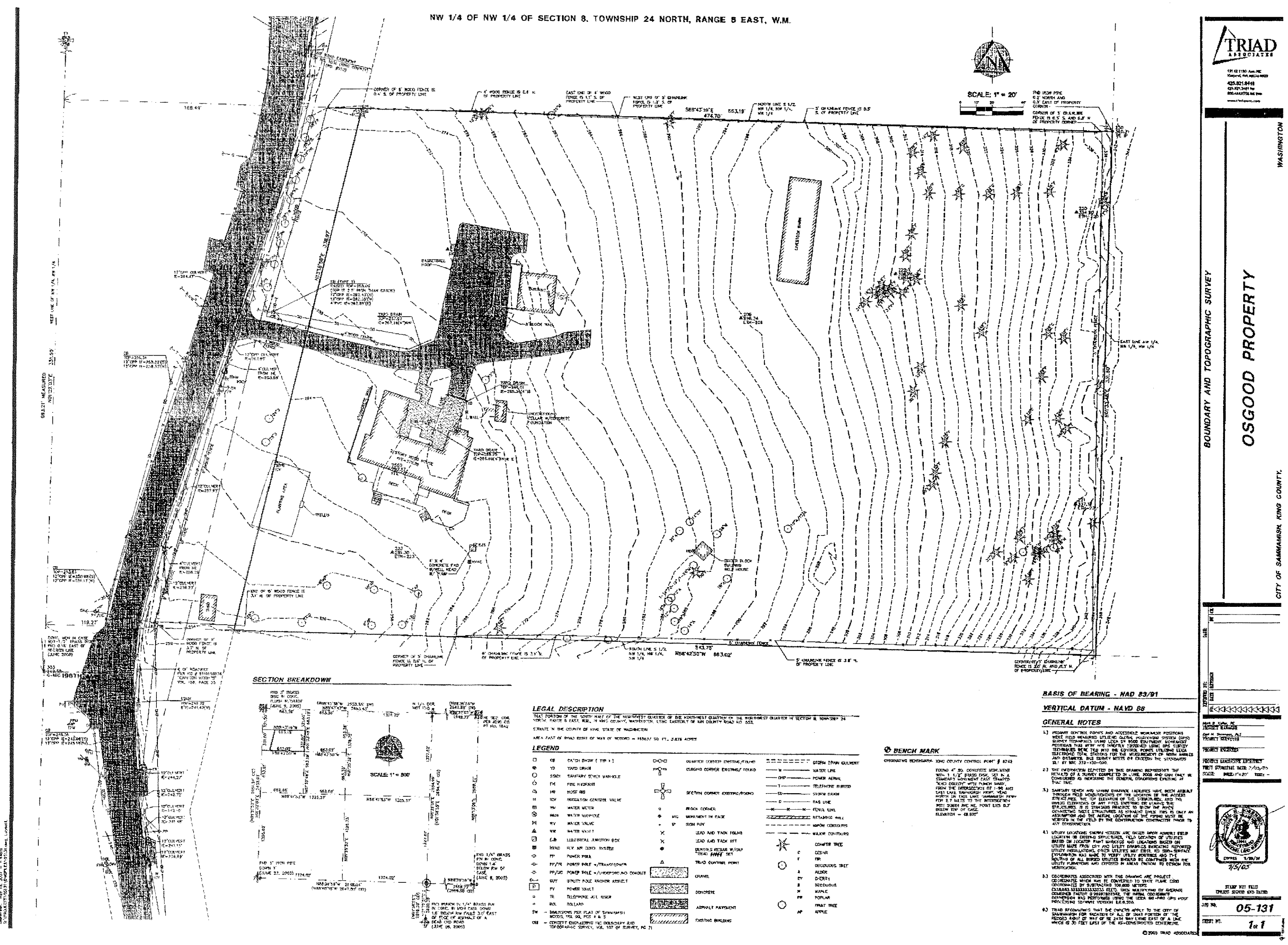
The Osgood Property is a 3.8 acre parcel located at 19661 SE 24th Way, Sammamish, WA 98075 (site). The associated parcel number is 0824069033. This analysis was performed to describe the existing and/or potential downstream impacts in association with potential future subdividing of the Osgood Property. Refer to the *Vicinity Map* below.



VICINITY MAP
N.T.S.

The site runoff drains into a single drainage basin. The layout of the site, including property lines, topography and existing features are shown on the *Site Map - Boundary and Topographic Survey* included at the end of this section. The natural discharge location is along the west property line. Site runoff exits via sheet flow to the adjacent ditch conveyance system along SE 24th Way. This runoff contributes to the Monohon Subbasin, which is tributary to the East Lake Sammamish Basin.

The *Study Area* is defined as the site's downstream flowpath to Lake Sammamish and also includes the offsite drainage area tributary to the site. See the *Downstream Study Area Map* and *Upstream Study Area Map* located at the end of this section for reference. This Level One Downstream Analysis follows the guidelines specified in Section 1.2.2 of the 2009 King County Surface Water Design Manual.


NW 1/4 OF NW 1/4 OF SECTION 8, TOWNSHIP 24 NORTH, RANGE 5 EAST, W.M.
SCALE: 1" = 20'
TRIAD ASSOCIATES
BOUNDARY AND TOPOGRAPHIC SURVEY
OSGOOD PROPERTY
CITY OF SAMMAMISH, KING COUNTY,
WASHINGTON
SECTION BREAKDOWN
SCALE: 1" = 500'
LEGAL DESCRIPTION
LEGEND
BENCH MARK
BASIS OF BEARING - NAD 83/91
VERTICAL DATUM - NAVD 88
GENERAL NOTES
05-131
1 of 1

MAP SOURCE

MAP SOURCE IS KING COUNTY IMAP.

MAP LEGEND

SEE SECTION 1.4 OF THE DOWNSTREAM ANALYSIS FOR A DRAINAGE DESCRIPTION AND/OR PICTURE OF AREA.

A — DRAINAGE COMPONENT LETTER

→ DRAINAGE COMPONENT FLOWPATH

#1 — DRAINAGE COMPONENT PHOTO

SEE SHEET 2

TRIAD ASSOCIATES
12112 116th Ave. NE
Kirkland, WA 98034-8829
425.821.6448
425.821.3481 fax
800.488.7788 toll free
www.triadassociates.net

DOWNSTREAM STUDY AREA MAP

OSGOOD PROPERTY

SAMMAMISH WASHINGTON

DATE: BY CK

DESCRIPTION: NO. DATE BY

PROJECT MANAGER
PROJECT SURVEYOR
PROJECT ENGINEER
PROJECT LANDSCAPE ARCHITECT
FIRST SUBMITTAL DATE: 3/8/13
SCALE: HORIZ. 1"= 150' VERT.: N/A

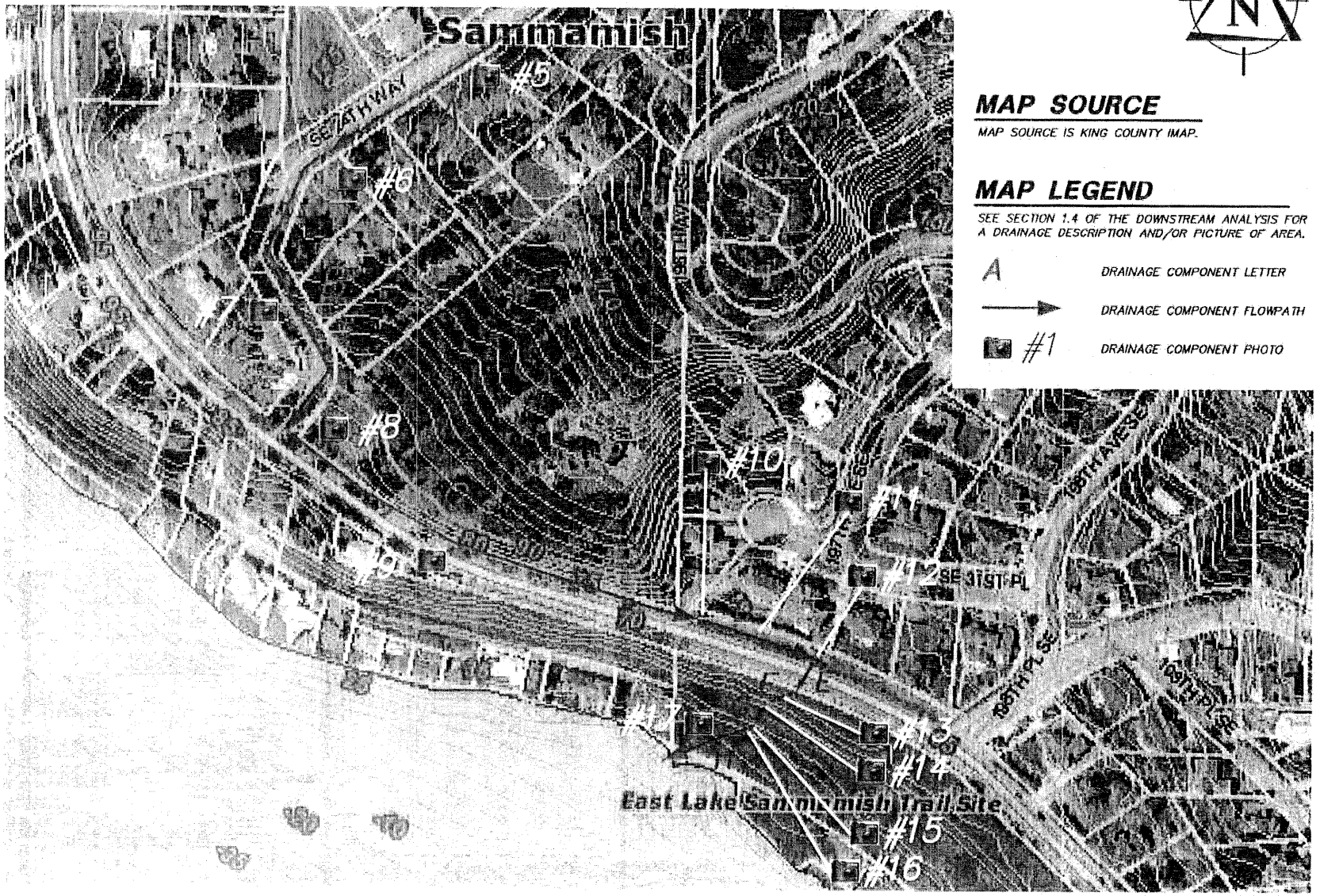
STAMP NOT VALID UNLESS SIGNED AND DATED

JOB NO. 05-131

SHEET NO. 1 of 2

Arthur, Mar 04, 2013 - 8:03am
E:\PROJECTS\05131\dwg\Base\Landscape\05131 Downstream Study Area Map.dwg, TDS01

SEE SHEET 1



MAP SOURCE

MAP SOURCE IS KING COUNTY IMAP.

MAP LEGEND

SEE SECTION 1.4 OF THE DOWNSTREAM ANALYSIS FOR A DRAINAGE DESCRIPTION AND/OR PICTURE OF AREA.

A — DRAINAGE COMPONENT LETTER

DRAINAGE COMPONENT FLOWPATH

#1 — DRAINAGE COMPONENT PHOTO

TRIAD ASSOCIATES
12112 116th Ave. NE
Kirkland, WA 98034-8629
425.821.8448
425.821.3481 fax
800.488.0598 toll free
www.triadassociates.net

DOWNSTREAM STUDY AREA MAP

OSGOOD PROPERTY

SAMMAMISH WASHINGTON

DATE: BY:

REVISED DATE: DESCRIPTION:

PROJECT MANAGER
PROJECT SURVEYOR
PROJECT ENGINEER
PROJECT LANDSCAPE ARCHITECT
FIRST SUBMITTAL DATE: 3/8/13
SCALE: HORIZ.: 1" = 150' VERT.: N/A

STAMP NOT VALID UNLESS SIGNED AND DATED

JOB NO. 05-131

SHEET NO. 2 of 2

klynn, Nov 04, 2013 - 9:04am
E:\PROJECTS\05131\civil\conception\05131 Downstream Study Area Map.dwg, TDS02

APPOXIMATE UPSTREAM TRIBUTARY BASIN (±12 ACRES)

MAP SOURCE

MAP SOURCE IS KING COUNTY IMAP.

TRIAD ASSOCIATES
425.821.8448

UPSTREAM STUDY AREA MAP

OSGOOD PROPERTY

SAMMAMISH WASHINGTON

DATE:

REVISED BY:

PROJECT MANAGER

PROJECT SURVEYOR

PROJECT ENGINEER

PROJECT LANDSCAPE ARCHITECT

FIRST SUBMITTAL DATE: 3/8/13

SCALE: HORIZ. 1"= 150' VERT. N/A

STAMP NOT VALID UNLESS SIGNED AND DATED

JOB NO. 05-131

SHEET NO. 1 of 1

plotted: Mar 07, 2013 - 1:47pm
G:\PROJECTS\05131\cadfile\conceptual\05131 Upstream Study Area Map.dwg, TDS01

2 RESOURCE REVIEW

2.1 Adopted Basin Plan

The site is located within the Monohon Subbasin, which is tributary the East Lake Sammamish Basin. See the *Drainage Subbasin Delineation Map* prepared by the City of Sammamish located at the end of this section for reference.

2.2 FEMA Maps

As indicated on the Flood Insurance Rate Map (# 53033C0680 F) the site is not located on or near a 100-year floodplain. See the *Flood Insurance Rate Map* prepared by FEMA located at the end of this section for reference.

2.3 Other Offsite Analysis Reports

A draft exhibit of the SE 24th Way conveyance system prepared by Wind Ward Environmental, LLC (a consultant for the City of Sammamish) was reviewed as part of the resource review of the Study Area. See the *SE 24th Way Existing Stormwater Infrastructure with Sub-basin Boundaries (Draft)* located at the end of this section for reference. No other offsite analysis reports were found to be within the Study Area.

2.4 Sensitive Areas Folio

The site and study area have been identified on the following City of Sammamish Maps:

Erosion: The site and portions of the study area are mapped as lying within a Erosion Hazard Area.

Landslide: The site and portions of the study area are mapped as lying within a Landslide Hazard Area.

Seismic: The site is not mapped as lying within a Seismic Hazard Area. The lower portion of the Study Area, near the outlet to Lake Sammamish, is mapped as lying within the Seismic Hazard Area.

Wetlands: The site and study area are not mapped as lying within a Wetland Area

Flood: The site and study area are not mapped as lying within a Flood Hazard Area.

See the *Environmentally Sensitive Areas Maps* prepared by the City of Sammamish located at the end of this section for reference.

2.5 Special District Overlays

As indicated on the *Special Overlay/Districts Map*, the site is mapped as lying within a City of Sammamish Special District Overlay SO-190. The SO-190 designation indicates that the site is located within a Erosion Hazards Near Sensitive Water Bodies (EHNSWB) Special District Overlay, as described in Sammamish Municipal Code 21A.50.225. See the *Special Overlay/Districts Map* located at the end of this section for reference.

2.6 Drainage Complaints

No drainage complaints were found to be within the Study Area over the last ten years in the City of Sammamish records. A meeting with the City of Sammamish Public Works staff (Eric LaFrance) on February 25, 2013, confirmed that there are no drainage complaints in the Study Area.

2.7 Road Drainage Problems

No road drainage problems were revealed in the Study Area resource review.

2.8 USDA Soil Survey

The USDA Soil Map indicates that the majority of the site consists of Alderwood Gravelly Sandy Loam (AgC), with 6 to 15 percent slopes. A small portion of the site, along the north and east property line, consists of Alderwood Gravelly Sandy Loam (AgD), with 15 to 30 percent slopes. Both of these soil types are classified as Hydrologic Soils Group 'C' or Till Conditions. See the *Soil Survey Map* prepared by USDA at the end of this section for reference.

2.9 Wetland Inventory Maps

There are no mapped wetlands on the site or in the Study Area per King County iMap. See the *Critical Areas Map* located at the end of this section for reference.

2.10 Migrating River Studies

No migrating river studies were revealed in the Study Area resource review.

2.11 WSDOE Clean Water Act Section 303d List

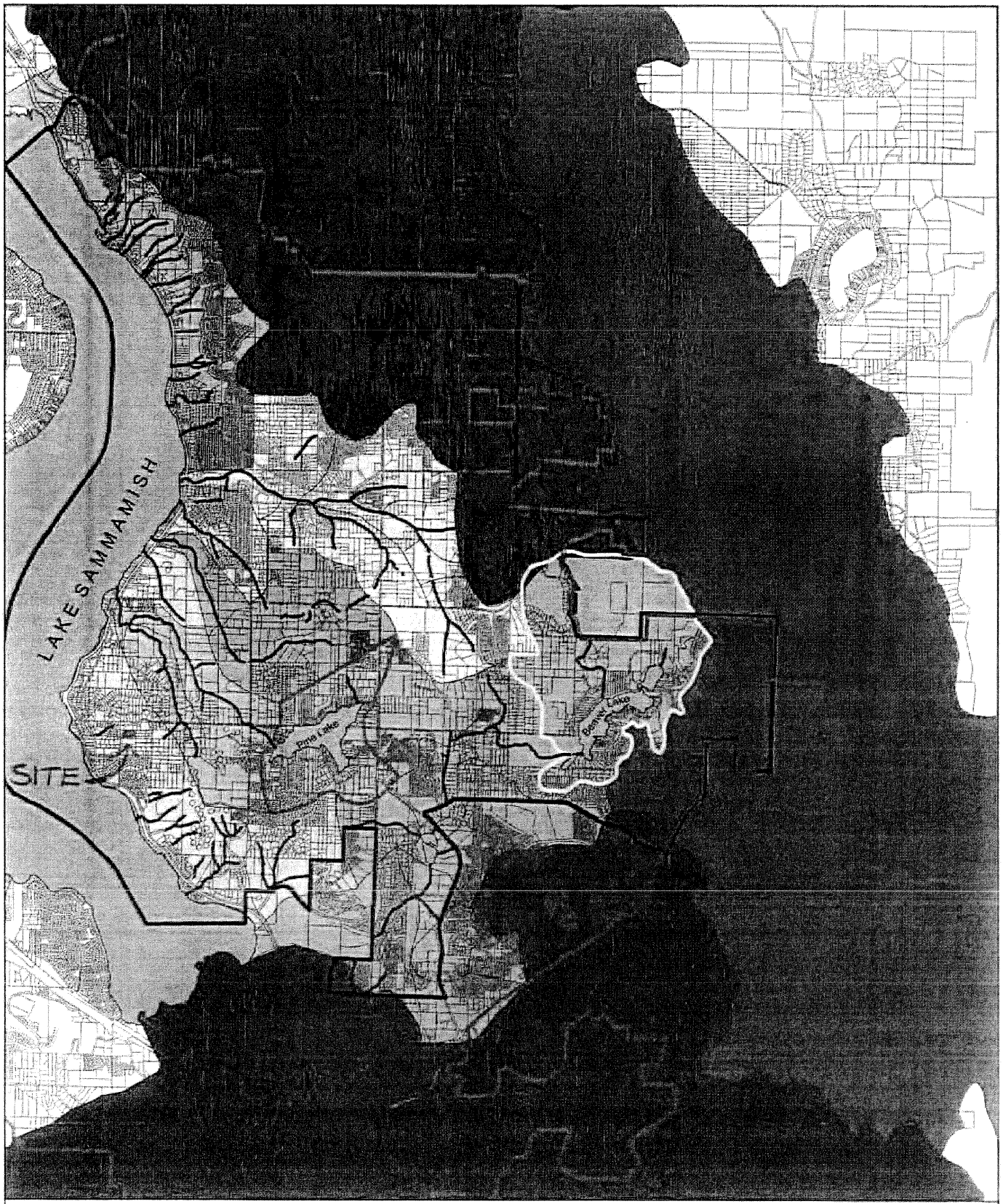
The Washington State Department of Ecology Clean Water Act Section 303d List of Polluted Waters listed Lake Sammamish as having a Total Phosphorus (category 2), Bacteria (category 5) and Dissolved Oxygen (category 5) problems. A copy of the Department of Ecology listing for Lake Sammamish has been included at the end of this section for reference.

2.12 King County Designated Water Quality Problems

King County iMap and the Reference Section 10 of the 2009 KCSWDM did not identify any water quality problems in the Study Area.

2.13 Stormwater Compliance Plans

The resource review did not reveal any stormwater compliance plans per the Department of Natural Resources - Water and Land Resources Division.



Drainage Subbasin Delineation

Plot Date: September 2003

Legend:

UGA | City Tax Lots | Lakes | Issaquah | Monohon | Pine Lake | Patterson | Beaver Lake Mgmt. District

City Limits | Streams | Bear Evans | Inglewood | Panhandle | Thompson | Laughing Jacobs | Pine Lake Drainage Area

Scale: 1 Inch = 1 Mile

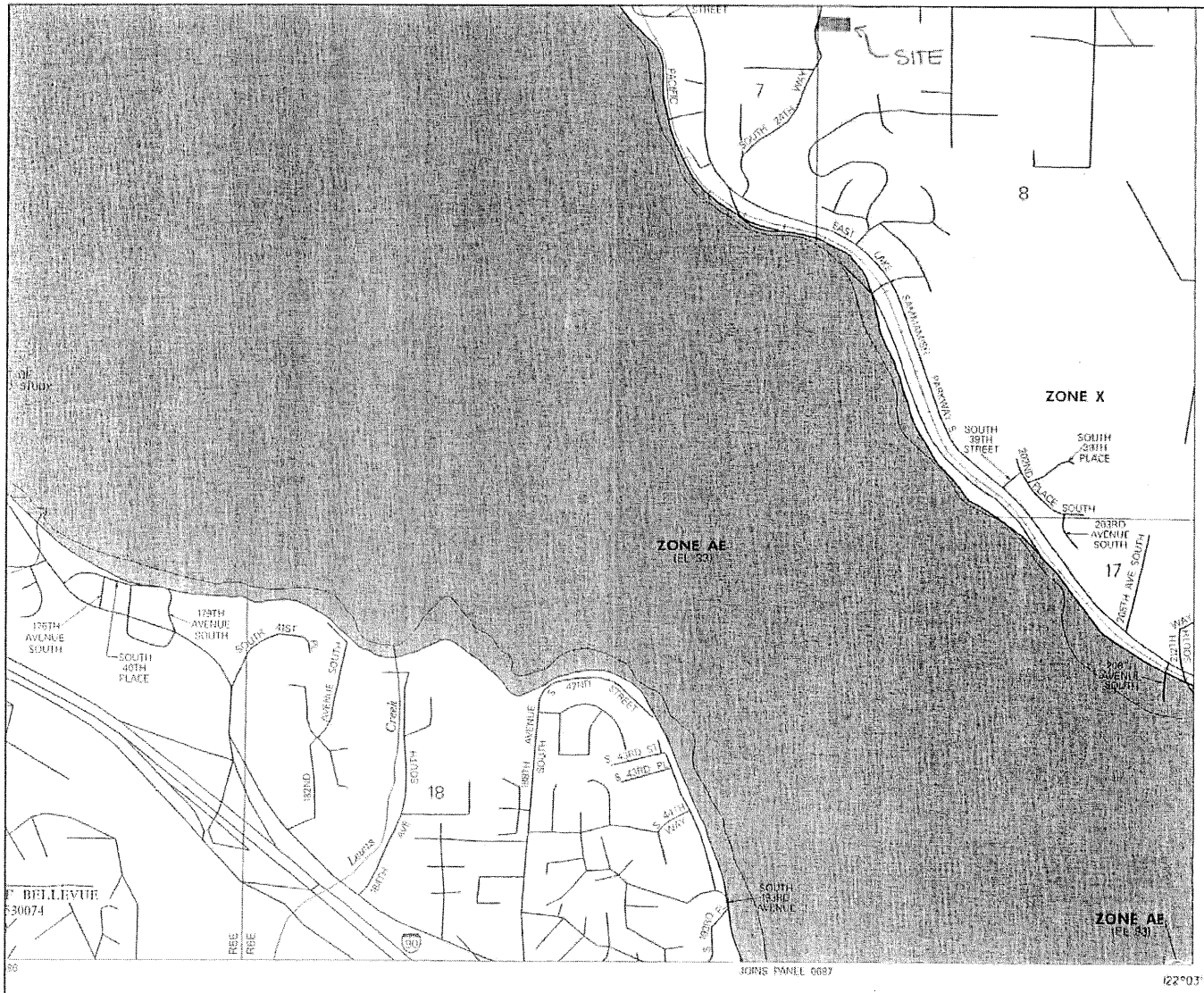
Miles

0.5 0.25 0 0.5

SOURCES: King County GIS CD#1, 3 Standard Data dated April 2003.

DISCLAIMER: This map is derived from various data sources. While care has been taken to ensure the accuracy of the information shown on this page the City of Sammamish assumes no responsibility or liability for any errors or omissions in this information. "This map is provided, "as is."

Figure IV-1



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

KING COUNTY, WASHINGTON AND INCORPORATED AREAS

PANEL 680 OF 1725

(SEE MAP INDEX FOR PANELS NOT PRINTED)

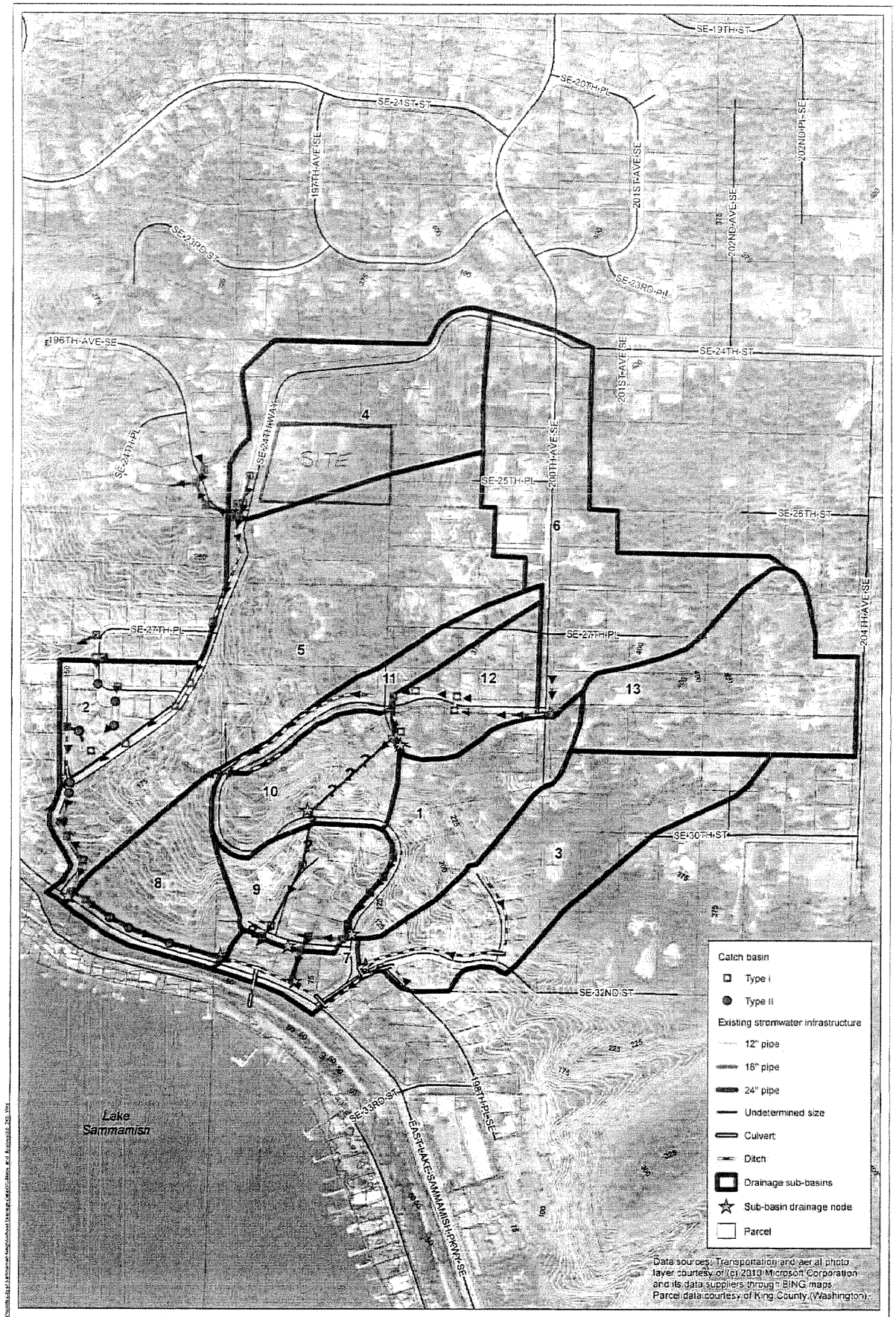
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BELLEVUE, CITY OF	530074	0680	F
KING COUNTY UNINCORPORATED AREAS	530071	0680	F

MAP NUMBER
53033C0680 F

MAP REVISED:
MAY 16, 1995

Federal Emergency Management Agency



Wind Ward environmental LLC

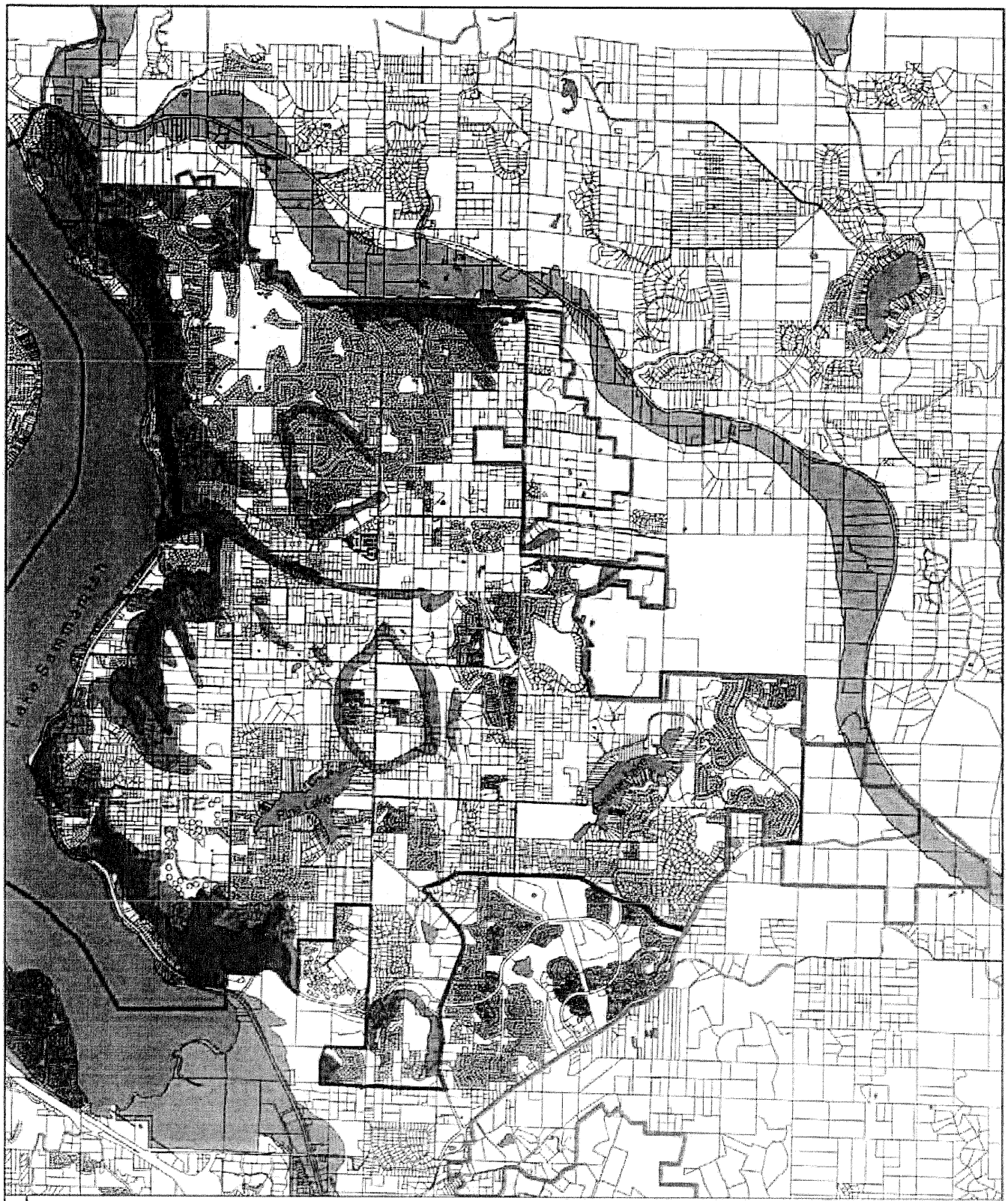
N

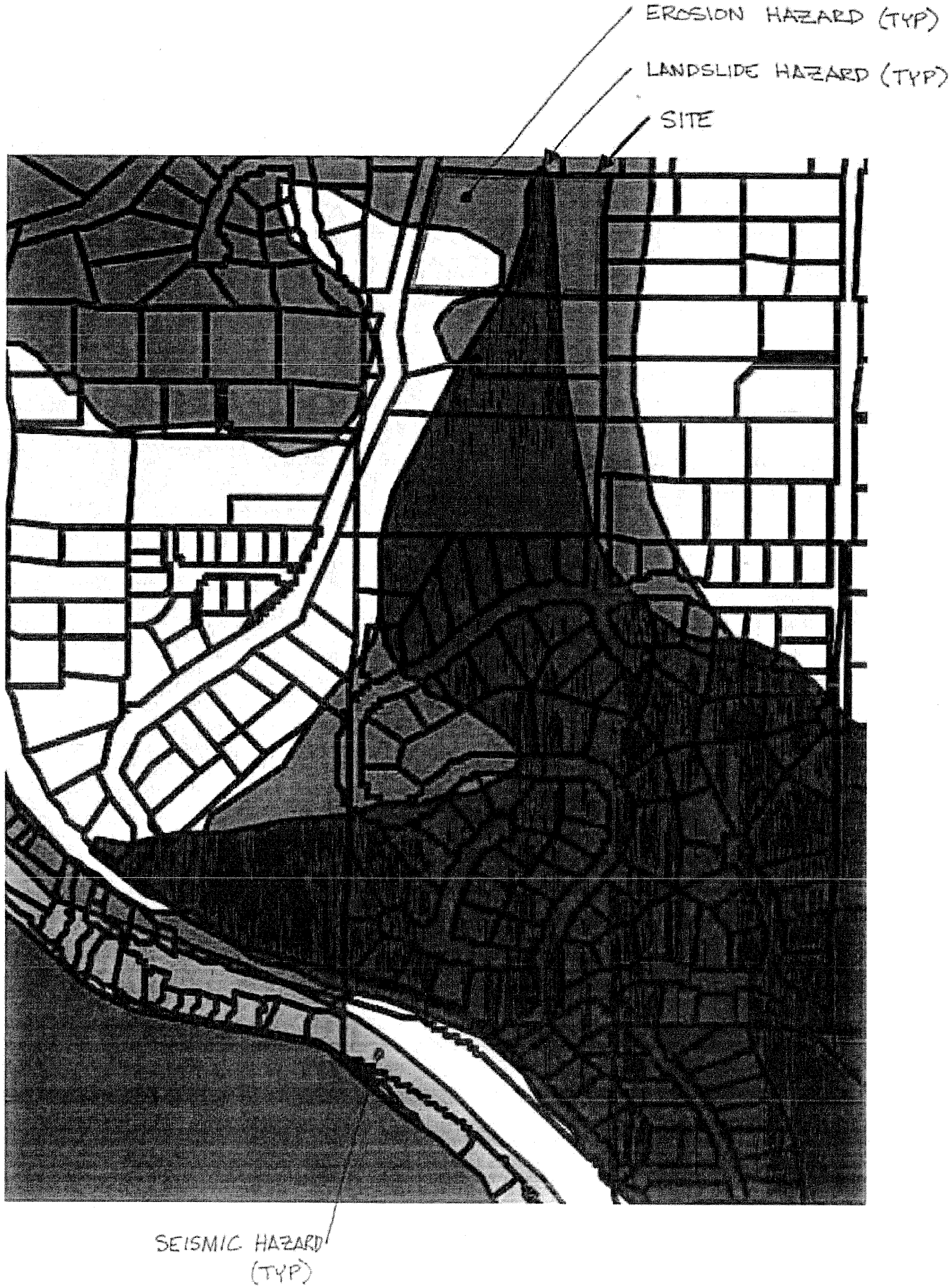
0 0.05 0.1 Miles

0 260 520 Feet

SE 24th Way existing stormwater infrastructure with sub-basin boundaries

DRAFT


Lake Sammamish
Environmentally Sensitive Areas
Geologic Hazards
Legend
UGA
Lake
City Limits
City Tax Lots
Erosion
Landslide
Seismic
A BLOWUP OF THE SITE HAS BEEN PROVIDED ON THE FOLLOWING PAGE
Scale 1" = 416 Ft
Plot Date: 02/03
Figure 3.1-9


EROSION HAZARD (TYP)
LANDSLIDE HAZARD (TYP)
SITE
SEISMIC HAZARD
(TYP)

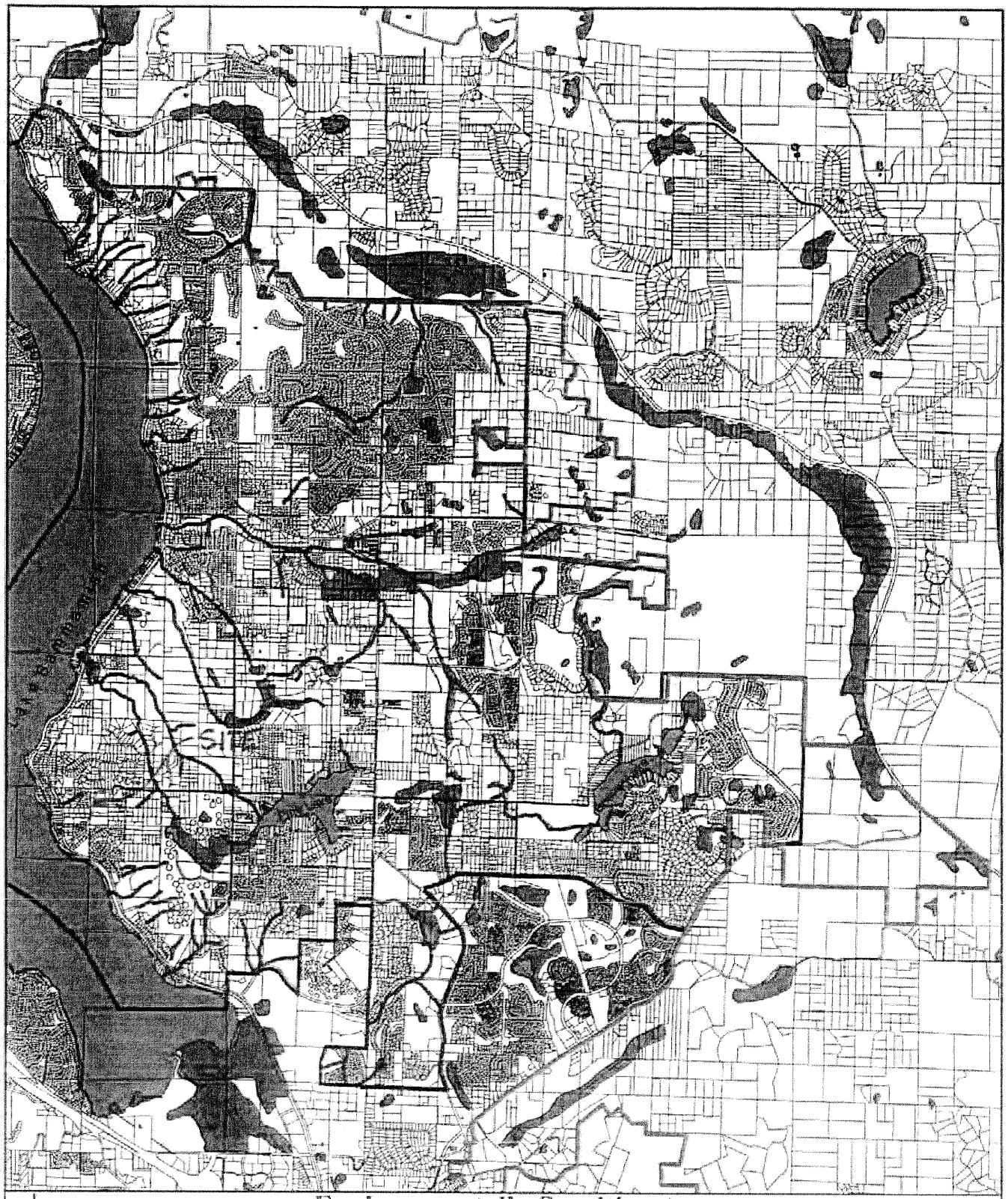

Environmentally Sensitive Areas
Surface Waters and Wetlands
Legend:
UGA
City Limits
City Tax Lots
Wetlands
Flood
Streams
100 0 100 Feet
Scale 1" = 416 Ft
Plot Date: 2/01
SOURCES: King County GIS CD #3 "Standard Data" dated March 2002
DISCLAIMER: This map is derived from various data sources. While care has been taken to ensure the accuracy of the information shown on this page the City of Snohomish assumes no responsibility or liability for any errors or omissions in this information. This map is provided "as is".

Figure 3.1-2

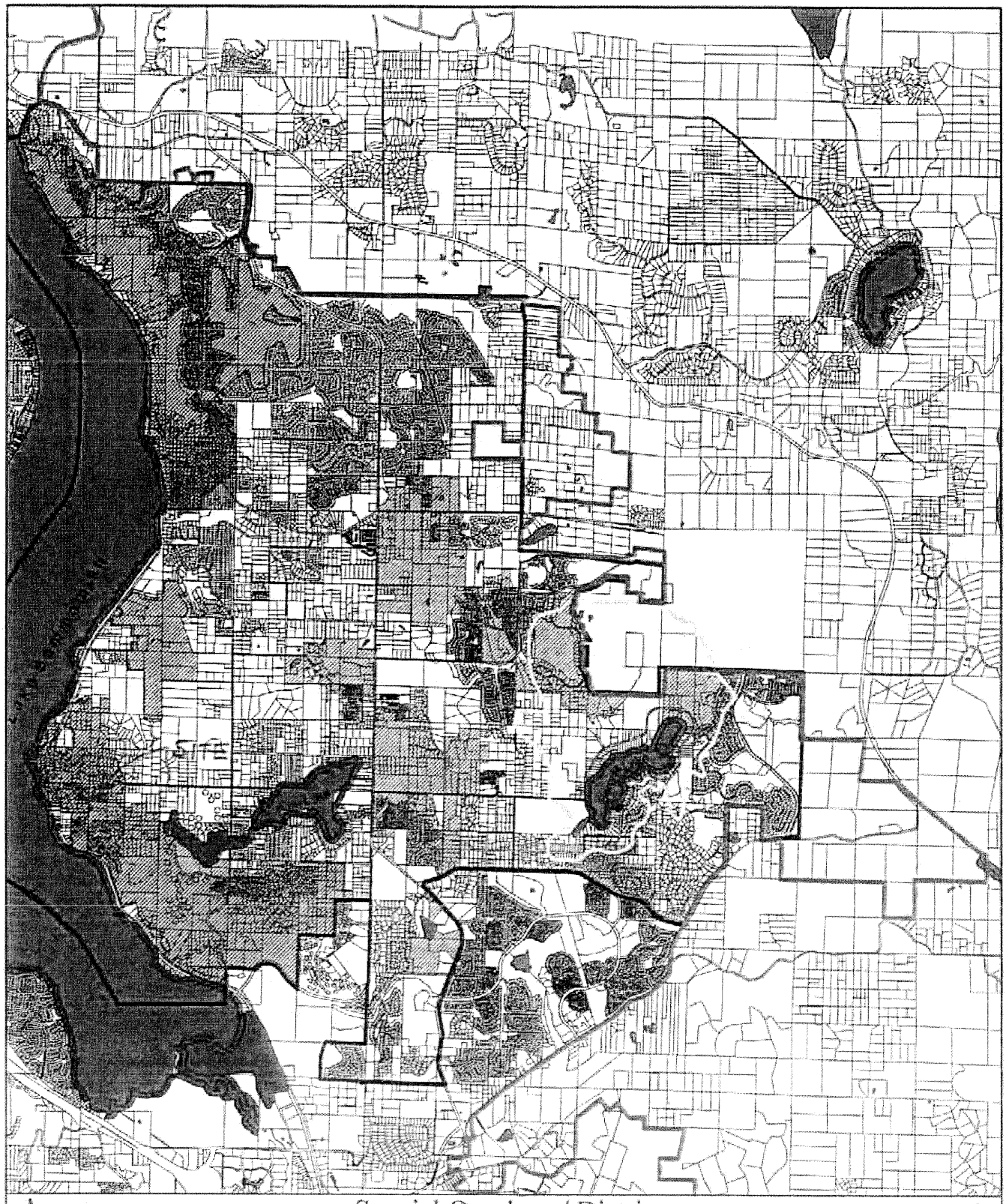
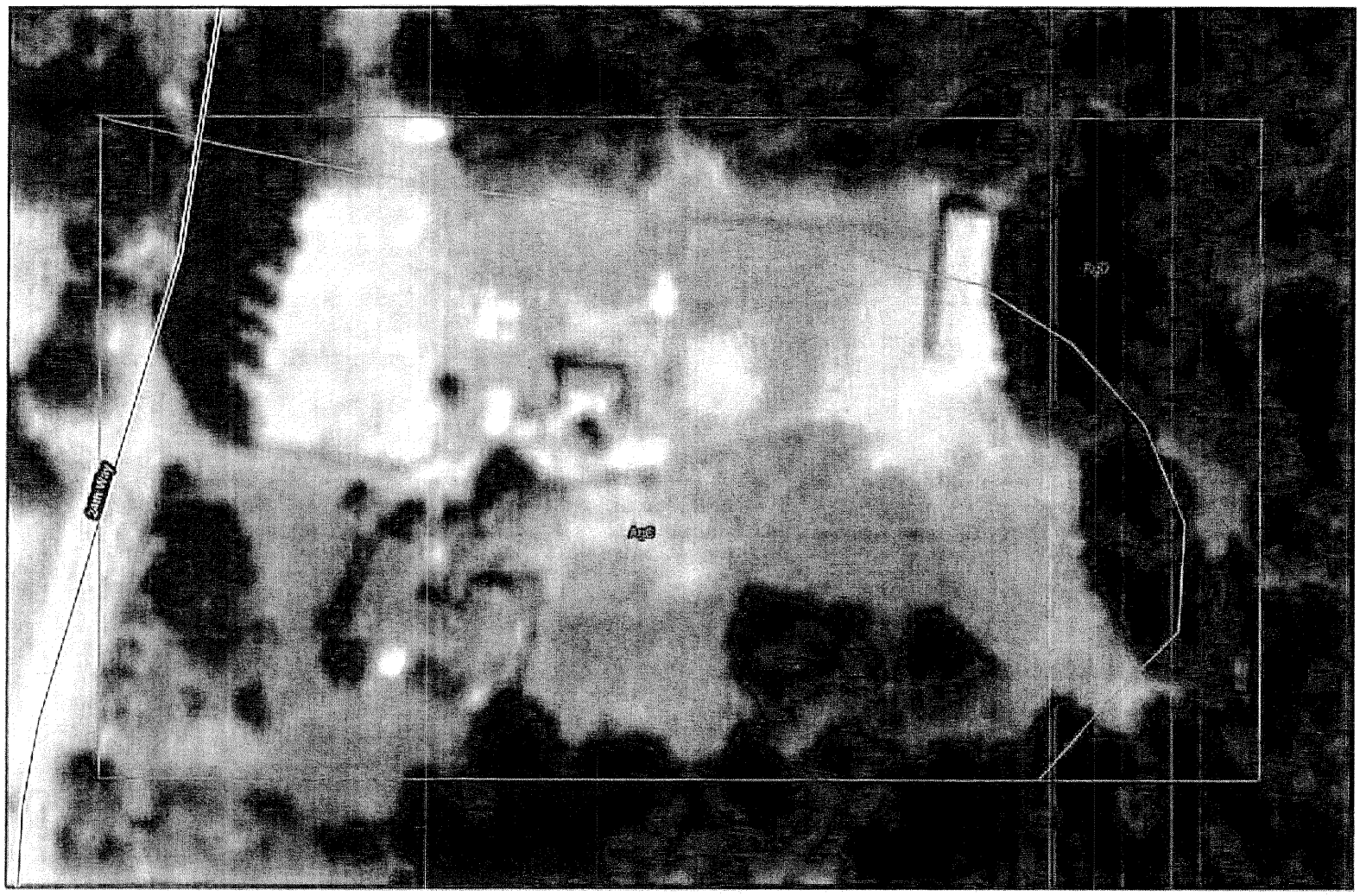

Special Overlays / Districts
Legend
UGA
City Limits
SO-180
SO-190
Lakes
City Tax Lots
Conservancy
Rural
Beaver Lake Mgmt. District
100 0 100 Feet
Scale 1" = 416 Ft
Plot Date: 2/03
SOURCES: King County GIS CD #3, "Standard Data" dated March 2002
DISCLAIMER: This map is derived from various data sources. While care has been taken to ensure the accuracy of the information shown on this map, the City of Sammamish assumes no responsibility or liability for any errors or omissions in this information. This map is provided "as-is"

Figure 3.1-7

Soil Map—King County Area, Washington
(Osgood Property - Soil Map)

122° 4' 41"
122° 4' 32"
47° 35' 15"
47° 35' 12"
47° 35' 11"



Map Scale: 1:667 if printed on A size (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:867 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 7, Jul 2, 2012

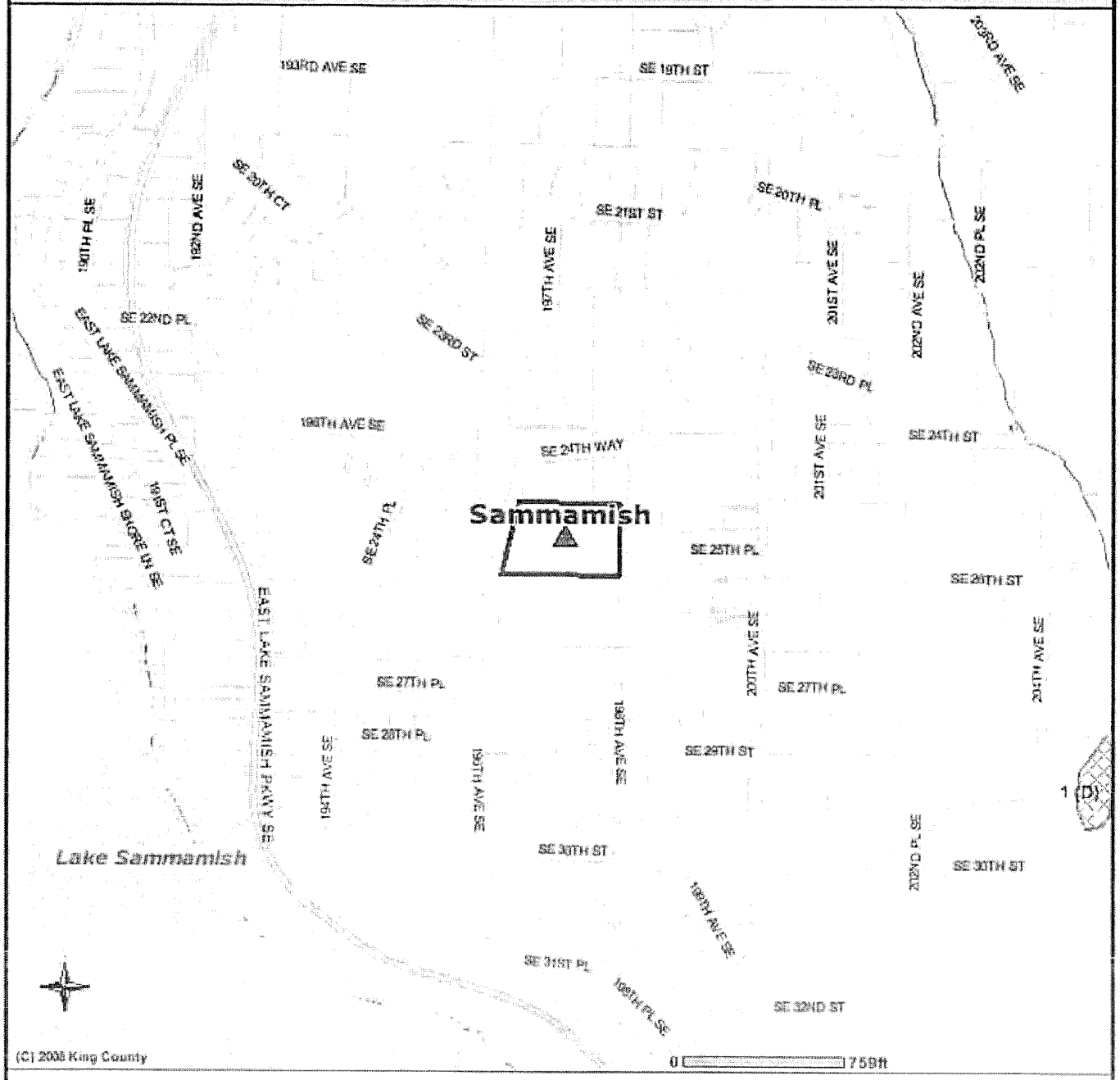
Date(s) aerial images were photographed: 7/24/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

King County Area, Washington (WA633)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AgC	Alderwood gravelly sandy loam, 6 to 15 percent slopes	2.7	75.6%
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes	0.9	24.4%
Totals for Area of Interest		3.5	100.0%

Critical Areas Map



Legend

- Highlighted Feature
- County Boundary
- Mountain Peaks
- Highways
- Incorporated Area
- Streets (cont)
- Highway
- Arterials
- Local
- Parcels
- Lakes and Large Rivers
- Streams
- SAO Wetland

Date: 2/26/2013 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GISAMAP)

King County

Washington State Department of Ecology - 303D Listing for Lake Sammamish

Listing ID	Waterbody	Medium	Parameter	2012 Category
6327	SAMMAMISH LAKE	Water	Total Phosphorus	2
11923	SAMMAMISH LAKE	Water	Endosulfan I	1
12162	SAMMAMISH LAKE	Water	Bacteria	5
12163	SAMMAMISH LAKE	Water	Bacteria	5
12167	SAMMAMISH LAKE	Water	Bacteria	5
15753	SAMMAMISH LAKE	Water	Dissolved Oxygen	5
52847	SAMMAMISH LAKE	Water	Total Phosphorus	1
52848	SAMMAMISH LAKE	Water	Total Phosphorus	1
52849	SAMMAMISH LAKE	Water	Total Phosphorus	1
52850	SAMMAMISH LAKE	Water	Total Phosphorus	1
52851	SAMMAMISH LAKE	Water	Total Phosphorus	1
52852	SAMMAMISH LAKE	Water	Total Phosphorus	1
52867	SAMMAMISH LAKE	Water	Total Phosphorus	1

3 FIELD INSPECTION

On February 25, 2013, a field inspection was performed on the Study Area to locate any existing or potential problems. The weather was overcast and approximately 50 degrees with small amounts of stormwater runoff in the public drainage systems from rainfalls the previous days. The following section (Section 4) of this report provides a detailed description of each drainage component in the downstream flowpath of the Study Area and provides information on the following items as applicable:

- Problems reported or observed during the resource review.
- Location of all existing/potential constrictions or lack of capacity in the existing drainage system.
- Description of all existing/potential downstream drainage problems.
- Description of existing/potential overtopping, scouring, bank sloughing or sedimentation.
- Description of drainage components (pipe sizes, channel characteristics, drainage structures, etc.).

4 DRAINAGE SYSTEM DESCRIPTION & PROBLEM DESCRIPTIONS

Below are descriptions and observations of each downstream component of the Study Area. These drainage components have been summarized in the *Offsite Analysis Drainage System Table* located at the end of this section and are shown (with camera locations) on the *Downstream Study Area Map* included at the end of Section 1. The slope of each drainage component was approximated using contours from King County iMap.

SITE FRONTAGE

Photo #1: Looking south along SE 24th Way in front of the site (on the left side).

Drainage Component 'A' ~ Ditch Flow (0' - 1,425')

Site runoff sheet flows to the west and exits at the east margin of SE 24th Way. This runoff is collected in a rip-rap armored ditch with 12" culverts at the driveway access points, and directed south along the east margin of SE 24th Way. The average slope of this drainage component is approximately 8%. As seen in the picture below, the ditch is in good condition at the start of this drainage component. The ditch has a 1-foot bottom width, 1- to 2-feet of depth with 1H:1V side slopes. The driveway culvert inlets near the site were free of debris and sediment. This portion of Drainage Component 'A' appeared to be well maintained by the City or adjacent property owners. No signs of erosion or flooding were observed along the upper portions of this drainage component.

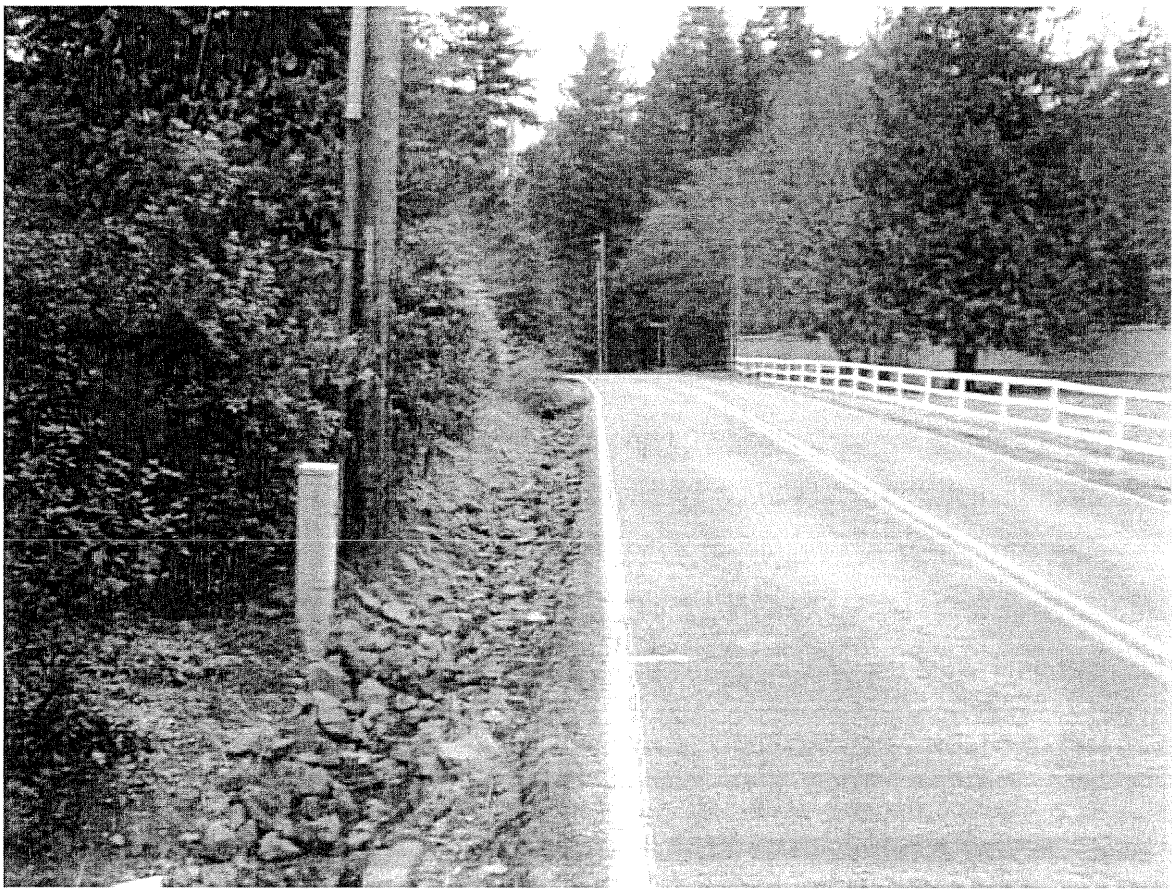


Photo #2: Looking south along the east margin of SE 24th Way. Upper reach of Drainage Component 'A' near the natural discharge location of the site.

Photo #3: Looking southwest along the east margin of SE 24th Way, near the SE 27th PL intersection.

The photo above shows Drainage Component 'A', approximately 450-feet from the site. The ditch section at this location is heavily vegetated and has a 1-foot bottom width, 1-foot in depth with 2H:1V side slopes. The rip-rap in the ditch at this location appeared to have settled over time, leaving exposed soil in portions of the ditch. This portion of Drainage Component 'A' did not appear to be regularly maintained by the City or adjacent property owners. Signs of erosion were present due to the lack of rip-rap in portions of the ditch. The driveway culvert inlets at the near this location had minor sediment accumulations. The capacity of the ditch appeared to be reduced due to the amount of vegetation within the ditch section. No signs of flooding were observed at this location.

Photo #4: Looking southwest along SE 24th Way, near the SE 28th PL intersection.

The photo above shows Drainage Component 'A', approximately 800-feet from the site. The partially rip-rap armored ditch section at this location, has a 1-foot bottom width, 2-feet in depth with 1H:1V side slopes. The capacity of the ditch appeared to increase relative to the original capacity near the upper portion of this drainage component. The rip-rap in the ditch at this location was in good condition and appeared to be regularly maintained by the City or adjacent property owner. No signs of flooding or erosion were observed at this location.

Photo #5: Looking southwest along SE 24th Way.

The photo above shows Drainage Component 'A', approximately 1,200-feet from the site. The ditch section at this location has a 1-foot bottom width, 1-foot depth with 1H:1V side slopes. The rip-rap in the ditch at this location was not visible due to the heavy vegetation. The driveway culvert inlets at the near this location had minor sediment accumulations. Sediment accumulations could be the result of adjacent gravel/dirt driveway entrances. The capacity of the ditch appeared to be reduced due to the amount of vegetation within the ditch section. This portion of Drainage Component 'A' did not appear to be regularly maintained by the City or adjacent property owner. No signs of flooding were observed at this location.

Drainage Component 'B' ~ 18" Pipe and Catch Basin System (1,425' - 1,875')

Runoff from Drainage Component 'A' enters an 18" pipe and catch basin system, approximately 1,425-feet from the site, near the intersection of SE 24th Way and 194th Avenue SE. The inlet into Drainage Component 'B' had minor sediment accumulation from Drainage Component 'A'. The catch basin rim near the intersection was compacted with gravel/dirt from the adjacent gravel driveway located at 19401 SE Way. It appears that this gravel/dirt is the result of loose debris from the driveway and not a result of the upstream drainage system. The average ground slope of this drainage component is approximately 16%. Minor sediment accumulations and about 1-foot of standing water were observed in the catch basin sumps. Photo's #6 (below), #7 and #8 (next page) show Drainage Component 'B' going towards Lake Sammamish. No visible signs of flooding were observed.

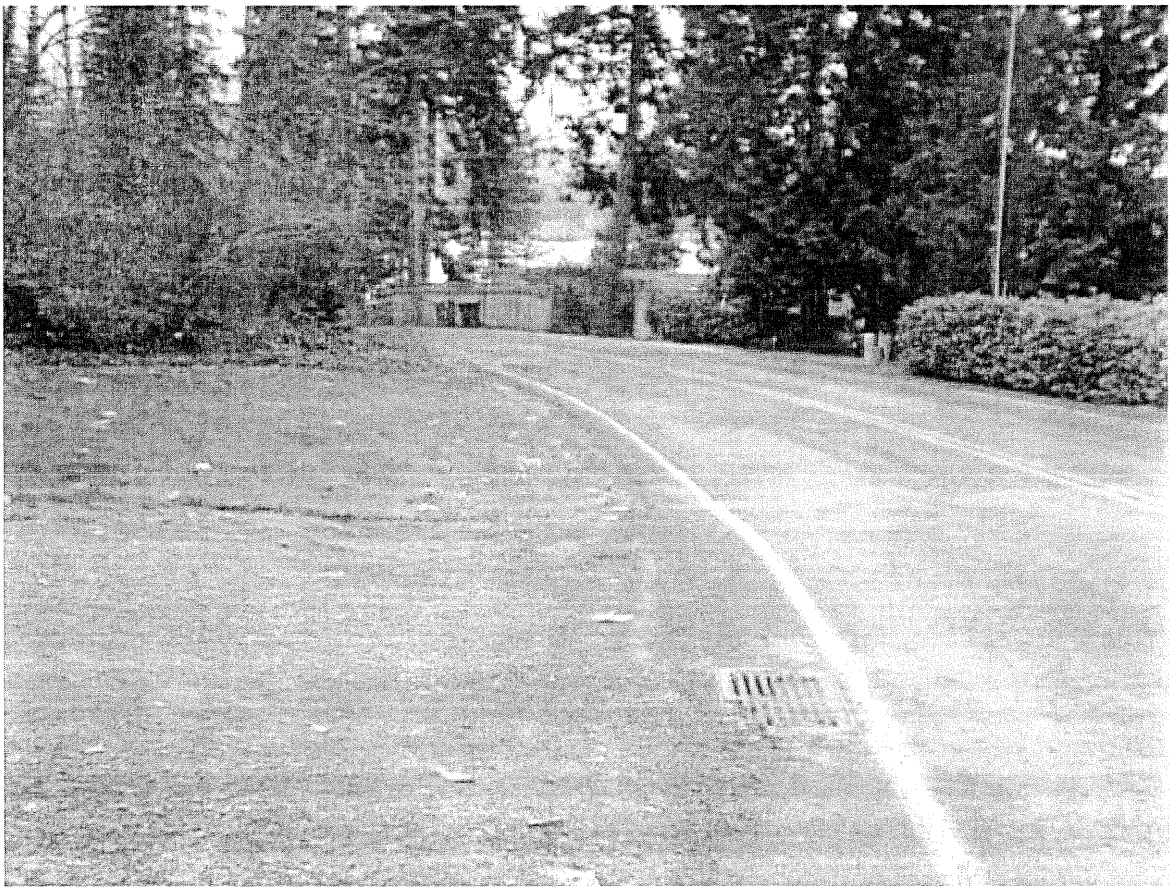


Photo #6: Looking southwest along the southeast margin of SE 24th Way, near the intersection of 194th Ave SE.

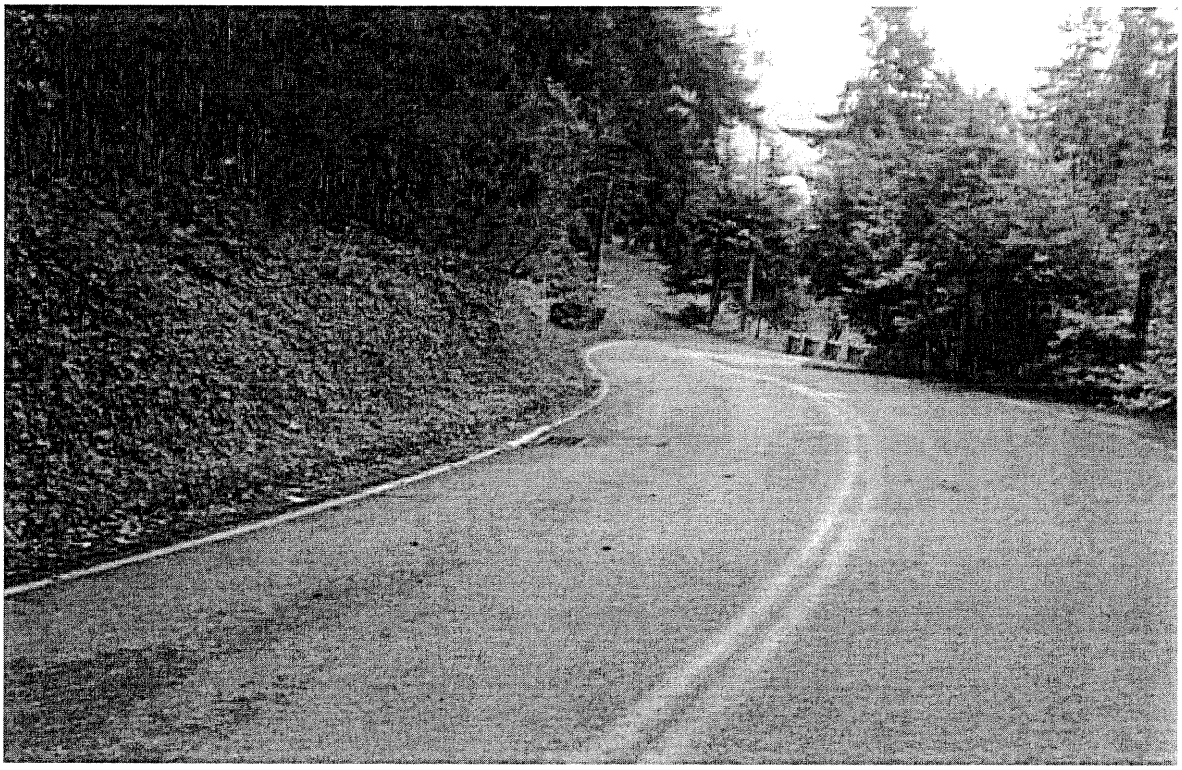


Photo #7: Looking south along SE 24th Way.

Photo #8: Looking southwest at the intersection of SE 24th Way and East Lake Sammamish Pkwy SE. (Photo taken on a rainy day in the beginning of February 2013).

Drainage Component 'C' ~ 24" Pipe and Catch Basin System (1,875' - 2,525')

From Drainage Component 'B', runoff enters the catch basin (show in Photo #8) near the intersection of SE 24th Way and East Lake Sammamish Pkwy SE. Drainage Component 'C' starts at the catch basin near the intersection. Runoff is directed to the southeast along the northeast margin of East Lake Sammamish Pkwy SE in a 24" pipe and catch basin system. The average slope of this drainage component is approximately 3%. Minor trash debris accumulation was observed near the catch basin inlets. No visible signs of erosion or flooding were observed.

Photo #9: Looking east along East Lake Sammamish Pkwy SE.

Drainage Component 'D' ~ Drainage Swale (2,525' - 2,625')

Runoff from Drainage Component 'C' enters a drainage swale located on the northeast margin of East Lake Sammamish Pkwy SE. Minor trash debris and sediment accumulation

were observed at the inlet and outlet of the drainage swale. This drainage swale has well establish vegetation consisting of tall grass/weeds. The swale had a 5-foot bottom width, 15- to 20-foot top width and was approximately 6-feet below the adjacent road. The average slope is approximately 2%. No signs of flooding were observed.

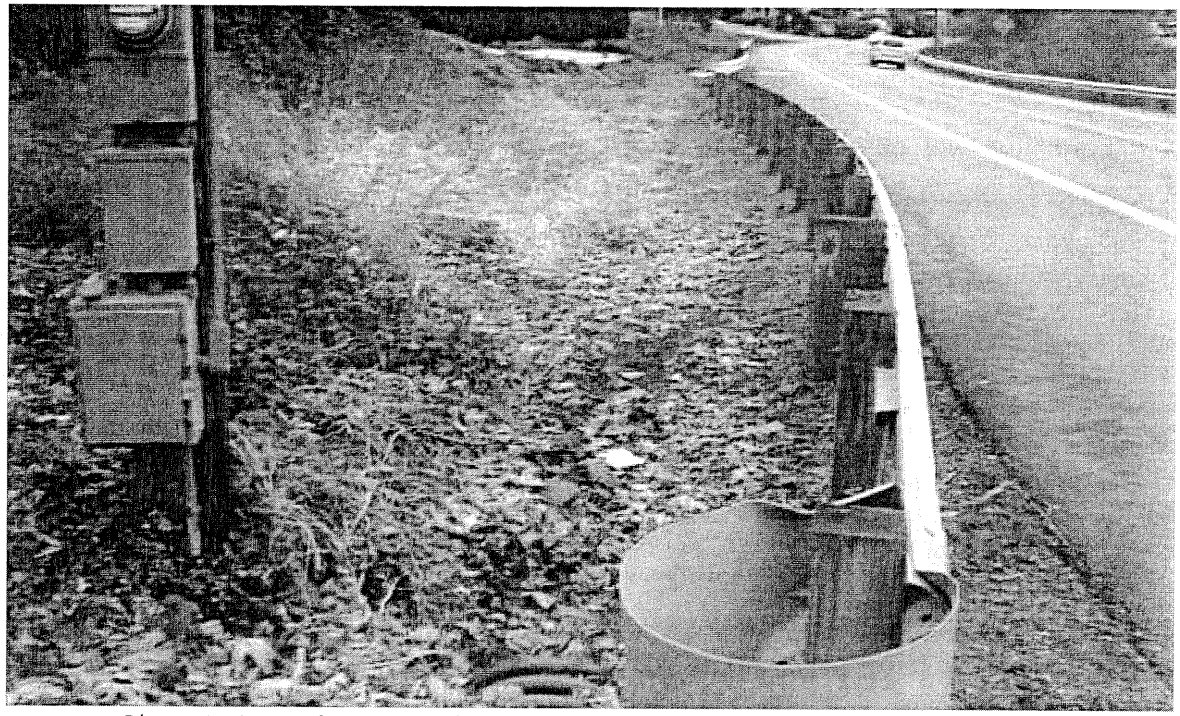


Photo #10: Looking east along East Lake Sammamish Pkwy SE at the inlet.

Photo #11: Looking east along East Lake Sammamish Pkwy SE.

Drainage Component 'E' ~ 24" Pipe (2,625' - 2,675')

Runoff exits the drainage swale and enters a 24" pipe and flows south, crossing under East Lake Sammamish Pkwy SE. This drainage component shown below was approximately 2,625-feet downstream of the site. The 24" pipe inlet was surrounded by well-established vegetation with minor sediment accumulation. The average slope of this drainage component is approximately 2% and the pipe outlet (on the south side of the East Lake Sammamish Parkway SE) discharged to a rip-rap pad. No signs of flooding were observed.

Photo #12: Looking south at the inlet of Drainage Component 'E' that crossing under East Lake Sammamish Pkwy SE.

Drainage Component 'F' ~ Gravel Channel (2,675' - 2,725')

Runoff from Drainage Component 'E' outlets south of East Lake Sammamish Pkwy SE to a gravel channel. Drainage Component 'F' consists of a meandering gravel channel with 1-foot bottom width and less than 1-foot deep. The average slope of Drainage Component 'F' is approximately 20%. The majority of this drainage component was not accessible due thick vegetation and relative steep slope. The end of this gravel channel appeared to have settled over time, leaving exposed soil in portions of the gravel channel. Signs of erosion were present due to the lack of gravel in the channel. This portion did not appear to be regularly maintained by the City or others. No signs of flooding were observed.

Photo #13: Looking northeast, near the outlet of Drainage Component 'F'. Surface water flows to the bottom left corner of the picture.

Drainage Component 'G' ~ 24" Pipe (2,725' - 2,750')

Runoff from Drainage Component 'F' enters a 24" concrete pipe and directs runoff south under the East Lake Sammamish Trail. Minor vegetation and sediment accumulation was observed at the inlet. The 24" pipe inlet was damaged but still functional. The average slope of this drainage component is approximately 2%. The pipe outlet on the south side of the Trail, discharged to a sheet of black plastic, anchored underneath the pipe (see photo #15). The pipe outlet of did not appear to be regularly maintained by the City or others. No signs of flooding were observed.

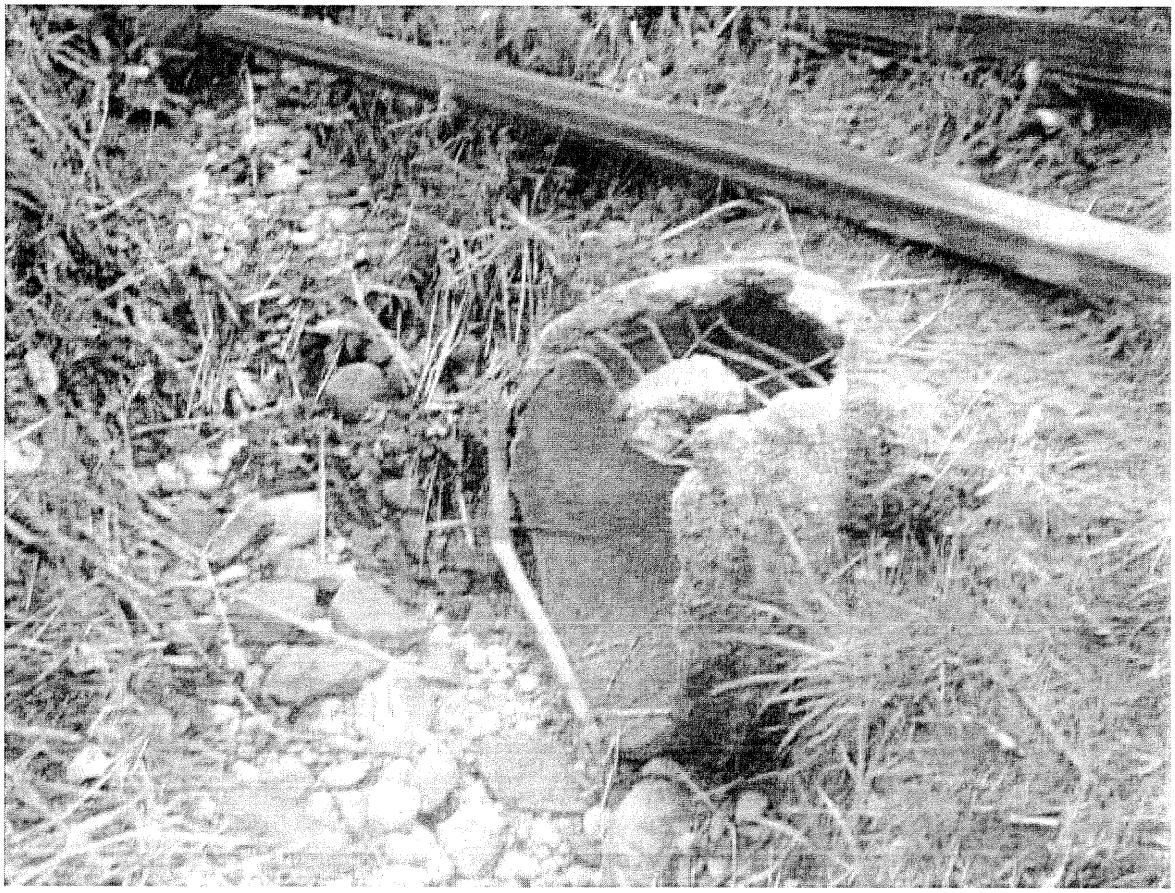


Photo #14: Looking at inlet of 24" pipe that crosses under East Lake Sammamish Trail.

Photo #15: Looking to the northeast at the outlet of the 24" pipe that crosses under the East Lake Sammamish Trail.

Drainage Component 'H' ~ Catch Basin Inlet to 18" Pipe (2,750' - 2,850'+)

Runoff from Drainage Component 'G' outlets to the south and enters a catch basin (see Photo #16). This catch basin outlets to the southwest into Lake Sammamish through an 18" pipe. The catch basin inlet was surrounded by heavy vegetation and moderate sediment accumulation. Standing water was observed at the invert of the inlet pipe in the catch basin. Access to the outlet of this pipe was restricted due to no trespassing signs on the adjacent private beach area. From the direction of the pipe orientation in catch basin, it appeared that the pipe outlet is in a rock bulkhead, north of the private beach, into Lake Sammamish. This is the last drainage component of the Study Area. Lake Sammamish is listed on the WSDOE 303d List of Polluted Waters for having Total Phosphorus (category 2), Bacteria (category 5) and Dissolved Oxygen (category 5) problems. See Section 5 for mitigation of these existing water quality problems.

Photo #16: Catch basin inlet of Drainage Component 'H'.

Photo #17: Looking southwest at Lake Sammamish, from the catch basin shown in Photo #16.

OFFSITE ANALYSIS DRAINAGE SYSTEM TABLE
SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: East Lake Sammamish Subbasin Name: Monohon Subbasin Number:

Drainage Component Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Average Slope	Distance from site discharge	Existing Problems	Potential Problems	Observations of field inspector, resource reviewer, or resident
see map	Type: sheet flow, Swale, stream, channel, pipe, pond; Size: diameter, surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	'/ mi = 1,320 ft.	constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		tributary area, likelihood of problem, overflow pathways, potential impacts
A	Ditch flow with 12" culverts at driveway entrances.	Rip-rap armored ditch in the northern and central portion of ditch segment. Heavily (un-maintained) vegetated in the southern portion of ditch segment. Ditch has 1' bottom width and a depth of 1'-2' feet in the northern portion. Ditch has a 1' bottom width and 1' of depth in the southern portion.	8%	0' to 1,425'	Minor sediment accumulation at the culvert inlets at driveways. Capacity of ditch is reduced along the southern portion of the ditch segment due to it being heavily vegetated.	Appears to have sufficient capacity. Site development would produce lower peak flows in the ditch, spread over a longer time period.	Overflow pathway would be along the shoulder of SE 24th Way until it reaches Drainage Component 'B'. With regular maintenance, the likelihood of a problem is minimal.
B	18" pipe and CB system.	18" pipes with Type 1 and 2 catch basins. Around 3' of cover over pipes. About 1' of standing water in the structures.	16%	1,425' to 1,875'	Sediment accumulation on CB rims due to loose dirt/gravel near CB's. About 1' of standing water in the CB sumps. Lower portion of drainage component located in a landslide hazard area.	Appears to have sufficient capacity. The drainage component is located in the paved shoulder so the landslide hazard does not appear to be an issue. Sediment accumulation might continue due to runoff from adjacent properties.	Overflow pathway would be along the eastern shoulder of SE 24th Way until it reaches Drainage Component 'C'. With regular maintenance, the likelihood of a problem is minimal.

C	24" pipe and CB system.	24" pipes and Type 2 catch basins. Around 3' of cover over pipes. About 1' of standing water in the structures.	3%	1,875' to 2,525'	No ponding around structures, minor trash debris around CB inlets. Located within a landslide hazard area and erosion hazard area.	Appears to have sufficient capacity. This drainage component is located in the paved shoulder so the landslide and erosion hazard does not appear to be an issue.	Overflow pathway would be along the northern shoulder of East Lake Sammamish Pkwy SE until it reaches Drainage Component 'D'. With regular maintenance, the likelihood of a problem is minimal.
D	Drainage swale.	Heavily vegetated swale, 5' bottom width and 15'-20' top width. Vegetation consisted of tall grass/weeds. Bottom of swale about 6' below adjacent road grade.	2%	2,525' to 2,625'	Minor trash debris/ sediment accumulation near inlet and outlet of swale. Located within a landslide hazard area.	Appears to have sufficient capacity. This swale has well established vegetation in and around the swale so the landslide hazard does not appear to be an issue.	Overflow pathway would be overtopping East Lake Sammamish Pkwy SE until it reaches Drainage Component 'E'. Given the large capacity of the drainage swale and with regular maintenance, the likelihood of a problem is minimal.
E	24" pipe crossing under East Lake Sammamish Pkwy SE.	Inlet of pipe has about 6-feet of cover going under road. Rip rap pad at pipe outlet.	2%	2,625' to 2,675'	Minor trash/sediment accumulation near the inlet of the pipe. Located within a landslide hazard area.	Appears to have sufficient capacity. The pipe inlet is surrounded by well established vegetation, the pipe outlet is protected by a rip rap pad and the pipe is secured in the road subgrade. The landslide hazard does not appear to be an issue.	Overflow pathway would be runoff backing up in the pipe into the drainage swale until it eventually overtops East Lake Sammamish Pkwy SE. Given the large capacity of the drainage swale and with regular maintenance, the likelihood of a problem is minimal.
F	Gravel channel.	Meandering channel 1' wide and less than one foot deep.	20%	2,675' to 2,725'	Erosion appears to be occurring due to the steep channel slope.	The capacity of this gravel channel is difficult to estimate because of the restricted access due to dense vegetation. Erosion is likely to continue due to the steep channel slope.	Overflow pathway would continue to be down the slope and most likely would flow into the 24" pipe in Drainage Component 'G'. With regular maintenance, the likelihood of a problem is minimal.

G	24" pipe crossing under East Lake Sammamish Trail.	About 2' of cover over the pipe. Trail is approximately 10' wide, gravel surfaced and experiences pedestrian and bicycle traffic. Minor damage to pipe inlet but still functional.	2%	2,725' to 2,750'	Minor vegetation/ sediment accumulation at the pipe inlet. Located within a seismic hazard area.	The capacity of this pipe appears to be sufficient. Sediment accumulation is likely to continue due to the steep channel slope upstream.	Overflow pathway would pond at the pipe inlet and would eventually over top the East Lake Sammamish Trail and would eventually reach Drainage Component 'H'. With regular maintenance, the likelihood of a problem is minimal.
H	CB inlet to18" pipe, with outlet to Lake Sammamish.	Heavy vegetation surrounding inlet CB. Standing water observed at invert of pipe. Approximate cover over pipe of two feet.	2%	2,750' to 2,850'+	Moderate sediment accumulation on and around inlet CB rim. Pipe outlets into Lake Sammamish. Located within a seismic hazard area.	No observed blockage in the 18" pipe. Sediment accumulation is likely to continue due to the steep channel slope in Drainage Component 'F'.	Overflow pathway would be runoff backing up in the pipe and overtopping the inlet catch basin. Runoff would then flow west towards Lake Sammamish across the private lawn and beach area. With regular maintenance, the likelihood of a problem is minimal.

5 MITIGATION OF EXISTING OR POTENTIAL PROBLEMS

5.1 Drainage Problems

There were two locations where existing offsite drainage problems within the Study Area were determined to be one of the three defined drainage problem types (conveyance system nuisance problem, severe erosion problem and severe flooding problem) specified in Section 1.2.2.1 of the 2009 KCSWDM. Drainage Components 'A' and 'F' were determined to be a conveyance nuisance problems. Mitigation measures for a conveyance nuisance problem can be applied on the site and along the drainage components, where the problem occurs, to prevent aggravation of the downstream drainage problem. During any potential future development of the site, it is recommended that temporary erosion and sedimentation control measures per the 2009 KCSWDM be applied during construction. In addition, the required permanent flow control facility on the site would also provide mitigation for the conveyance nuisance problem. Futhermore, the permanent flow control facility on the site is planned to be designed and constructed to conform to the City's adoption of the 2009 KCSWDM, using the Level 3 flow control standard. Compliance with the Level 3 flow control standard would reduce the post-development flows to be less than the pre-development flows from the site modeled in the forested condition.

Offsite mitigation measures would also help reduce the risk of erosion and sedimentation in the Study Area. Along Drainage Components 'A' and 'F', the placement of rip rap in the ditch/channel where exposed soil is present and increasing the overall rip rap thickness in the ditch/channel is an appropriate mitigation measure. Regular maintenance of the Study Area would also help alleviate the conveyance nuisance problems. Excerpts from the 2009 KCSWDM - Maintenance and Operation Section have been included at the end of this section for reference. The combination of on site and offsite mitigation measures would reduce the risk of aggravating the existing downstream conveyance nuisance problems.

5.2 Water Quality Problems

There were three identified existing offsite water quality problems in the Study Area. Lake Sammamish is listed on the WSDOE 303d List of Polluted Waters for having Total Phosphorus (Category 2 Water), Bacteria (Category 5 Water) and Dissolved Oxygen (Category 5 Water) water quality problems. Mitigation measures for Total Phosphorus, Bacteria and Dissolved Oxygen water quality problems are required for Categories 5, 4 and 2 Water. See the following subsections of this report for the required mitigation measures for the specific water quality problems.

5.2.1 Total Phosphorus Mitigation

Mitigation of the Total Phosphorus water quality problem can be accomplished by (1) providing the Sensitive Lake treatment standard and by (2) applying the Erosion and Sediment Control Standards with the assumption that the project is located within a designated Sensitive Lake Water Quality Treatment Area. The permanent water quality facility on the site is planned to be designed and constructed to conform to the City's adoption of the KCSWDM and per the EHNSWB Special District Overlay Pilot Program, which increases the required Total Phosphorus removal rate to 60%.

5.2.2 Bacteria Mitigation

Mitigation of the Bacteria water quality problem can be accomplished by providing an onsite water quality facility in the form of a sand filter or stormwater wetland. Other water quality facilities that may be used in lieu of a sand filter or stormwater wetland, only if it is followed by an emerging technology treatment method that provides an equivalent removal rate of fecal coliform. The equivalent removal of fecal coliform must be demonstrated through an experimental design adjustment per Section 1.4 of the 2009 KCSWDM. In addition, signage must be provided in the public areas of the residential development requesting that pet waste be picked up in order to protect the downstream water quality.

5.2.3 Dissolved Oxygen Mitigation

Mitigation of the Dissolved Oxygen water quality problem can be accomplished by two options. If the Dissolved Oxygen water quality problem is documented to be caused by excessive nutrients, then selecting a treatment facility option from the Sensitive Lake Protection menu of the 2009 KCSWDM is proper mitigation. Treatment facility options for the Sensitive Lake Protection menu include a large wetpond, large sand filter, a two-facility treatment train from Table 6.1.3.A of the 2009 KCSWDM or a facility from the Basic treatment menu with phosphorus credit as described in Section 6.1.3 of the 2009 KCSWDM. At the time of the resource review of the Study Area, documentation of why Lake Sammamish has a Dissolved Oxygen water quality problem was not found.

Another mitigation option for the Dissolved Oxygen water quality problem is through the use of a wetpond or wetvault. Additional design criteria from the standard design criteria specified in the 2009 KCSWDM would apply. These additional requirements include: (1) limiting the depth of water quality storage to 6-feet and the system outlet shall be designed to promote aeration of the 2-year peak storm event or smaller. Proper aeration could be accomplished by having the facility outlet discharge to an open channel, placing the outlet pipe elevation a minimum of 12-inches above the 2-year tailwater elevation in the open channel, (2) the ventilation requirement per Chapter 6 of the 2009 KCSWDM for a wetpond or wetvault shall be doubled.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance.**	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance.**	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

NO. 8 – ENERGY DISSIPATERS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed.
Site	Trash and debris	Trash and/or debris accumulation.	Dissipater clear of trash and/or debris.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Rock Pad	Missing or moved Rock	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil.	Rock pad prevents erosion.
Dispersion Trench	Pipe plugged with sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not discharging water properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench).	Water discharges from feature by sheet flow.
	Perforations plugged.	Over 1/4 of perforations in pipe are plugged with debris or sediment.	Perforations freely discharge flow.
	Water flows out top of "distributor" catch basin.	Water flows out of distributor catch basin during any storm less than the design storm.	No flow discharges from distributor catch basin.
	Receiving area over-saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Gabions	Damaged mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.	Mesh is intact, no rock missing.
	Corrosion	Gabion mesh shows corrosion through more than ¼ of its gage.	All gabion mesh capable of containing rock and retaining designed form.
	Collapsed or deformed baskets	Gabion basket shape deformed due to any cause.	All gabion baskets intact, structure stands as designed.
	Missing rock	Any rock missing that could cause gabion to loose structural integrity.	No rock missing.
Manhole/Chamber	Worn or damaged post, baffles or side of chamber	Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure is in no danger of failing.
	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch or any evidence of soil entering the structure through cracks, or maintenance inspection personnel determines that the structure is not structurally sound.	Manhole/chamber is sealed and structurally sound.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No soil or water enters and no water discharges at the joint of inlet/outlet pipes.

NO. 13 – BASIC BIOFILTRATION SWALE (GRASS)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Any trash and/or debris accumulated on the bioswale site.	No trash or debris on the bioswale site.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Swale Section	Sediment accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.	No sediment deposits in grass treatment area of the bioswale.
		Sediment inhibits grass growth over 10% of swale length.	Grass growth not inhibited by sediment.
		Sediment inhibits even spreading of flow.	Flow spreads evenly through swale
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Poor vegetation coverage	Grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Swale has no bare spots and grass is thick and healthy.
	Grass too tall	Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation has taken over.	Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.
	Excessive shade	Grass growth is poor because sunlight does not reach swale.	Health grass growth or swale converted to a wet bioswale.
	Constant baseflow	Continuous flow through the swale, even when it has been dry for weeks or an eroded, muddy channel has formed in the swale bottom.	Baseflow removed from swale by a low-flow pea-gravel drain or bypassed around the swale.
	Standing water	Water pools in the swale between storms or does not drain freely.	Swale freely drains and there is no standing water in swale between storms.
	Channelization	Flow concentrates and erodes channel through swale.	No flow channels in swale.
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.